CENTER FOR **EMERGING AND INNOVATIVE SCIENCES**

AT THE UNIVERSITY OF ROCHESTER

ANNUAL REPORT **2023–2024**

CONTENTS

A quantum processor semiconductor chip is shown connected to a circuit board (Produced in John Nichol's lab at University of Rochester).

Photo credit: J. Adam Fenster, University of Rochester

CEIS DIRECTORS' MESSAGE

As I reflect on the past year, I am inspired by how the Rochester region continues to lead through innovation, collaboration, and growth. At CEIS, we are steadfast in our mission to advance New York's economy by connecting cutting-edge university research with industry and leveraging our region's unique strengths to drive job creation, fuel innovation, and build a thriving economy.

This year, we strengthened our focus on initiatives that consolidate Rochester's leadership in imaging and artificial intelligence (AI). With a storied legacy in optics and imaging, our region is naturally positioned to lead advancements in AI applications spanning diverse sectors such as healthcare, advanced manufacturing, defense, agriculture, and environmental protection. Through strategic university-industry partnerships, CEIS is fostering transformative breakthroughs in these areas, enabling our companies and researchers to remain at the forefront of this rapidly evolving field.

In parallel, we expanded efforts to nurture the emerging cluster in audio technology and music. Rochester's rich history in imaging and cinema, central to CEIS's imaging mission, spurred the development of an allied cluster in music and sound production. Nationally prominent resources like the Eastman School of Music, founded by a gift from George Eastman in 1921, and the growing programs in audio technology at the UR and RIT uniquely positions our region as leaders in this field. Our goal is to unite the more than 20 regional companies in this space with our world-class institutions to drive collaboration, attract investment, and create jobs. A key highlight of these efforts is CEIS's leadership in producing the SoundtraX Festival, a one-of-a-kind event blending technical and musical innovation for film and other contemporary media. This festival not
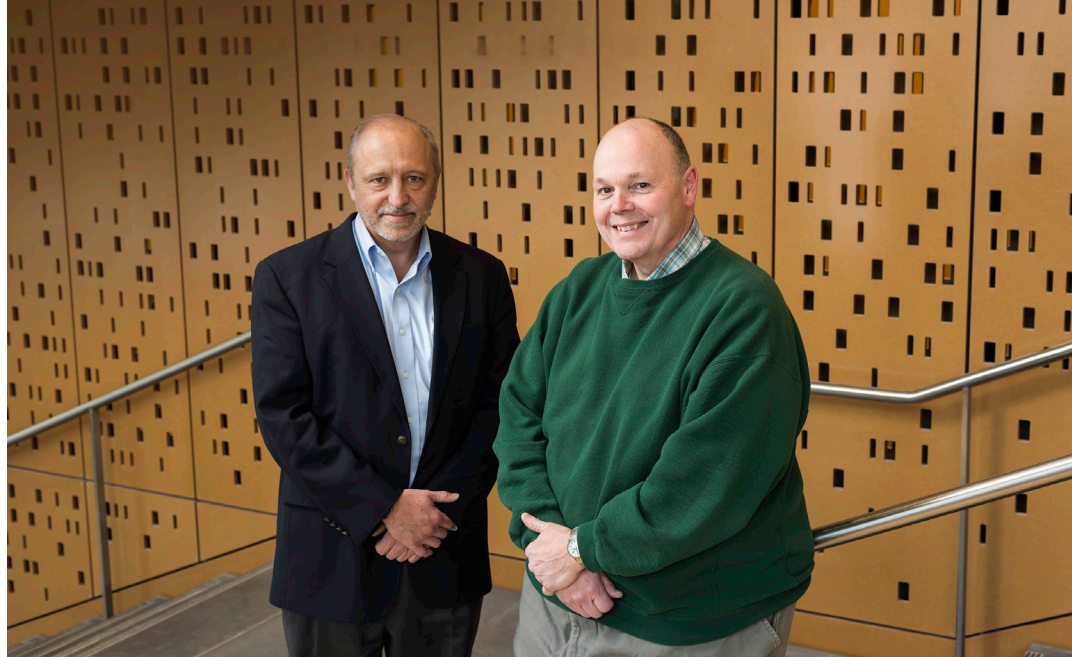
only showcases Rochester's strengths in audio technologies and music and media production but also bolsters our reputation as a hub for audio and media innovation on a global scale.

Beyond these focus areas, CEIS is committed to helping a broad spectrum of companies across the region. From advancing precision materials to supporting life sciences and semiconductor packaging, our goal is to ensure that businesses of all sizes and sectors have the tools, resources, and partnerships they need to thrive. A diverse and vibrant economy benefits everyone, and we are proud to create opportunities that strengthen communities and businesses across Upstate New York. The impact of our work is measurable and significant. Over the past year, CEIS facilitated university-industry collaborations that turned a $1M investment of state funds into over $27M in regional economic impact and created 16 new jobs. These outcomes demonstrate the power of collaboration and the vast potential for continued growth.

In this report, you'll find stories that highlight the breadth and depth of our work. From advancing imaging technologies with AI and improving the reliability of audio interfaces for first responder communications to exploring new applications for advanced materials in optical systems, CEIS continues to be at the forefront of impactful innovation. You'll also read about our continued focus on the semiconductor industry, where our region

is making critical contributions in chip packaging and design, aligning with New York State's broader initiatives to lead in this pivotal sector.

I want to express my deepest gratitude to our partners and supporters. Our work would not be possible without the commitment of Governor Kathy Hochul, Assemblymember Harry Bronson, and NYSTAR. I am also thankful for the dedicated faculty at the University of Rochester and Rochester Institute of Technology who drive innovation, as well as the businesses and entrepreneurs who inspire us with their creativity and determination. A special thank you to the CEIS team—Cathy Adams, Margaret Urzetta, Dr. J. Daniel Newman, and Jack Ager whose hard work and dedication make our success possible.

Together, we are shaping a brighter future and building a stronger economy for Rochester and New York State. Whether you are a long-time collaborator or a new partner, thank you for joining us on this journey. We look forward to continuing this important work with you in the coming year.

Sincerely,

*Mark F. Bocko*

Mark F. Bocko, Director

Paul H. Ballentine

Paul H. Ballentine, Executive Director

FINGER LAKES SCIENCE AND **TECHNOLOGY SHOWCASE**

Our annual Finger Lakes Science & Technology Showcase, held in collaboration with NYSTAR Center of Excellence in Data Science, took place on April 25, 2024, at the Memorial Art Gallery. The showcase is an opportunity for researchers from the University of Rochester, Rochester Institute of Technology, and surrounding universities to present their work to industry attendees as well as other researchers and organizations that promote economic development. The goal is to stimulate discussions that may lead to industry-university collaboration.

The day began with the student-run Western New York AR/VR Mini Symposium. The four speakers for the event were Andreas Georgiou, an optics consultant from Cambridge, UK, N. Katherine Hayles from Duke University's Price Lab for Digital Humanities, and our Rochester Institute of Technology colleagues Chao Peng from the School of Interactive Games and Media and Wendy Dannels at the National Technical Institute of the Deaf.

Ben Verschueren, the Executive Director of Empire State Development's Division of Science, Technology and Innovation (NYSTAR), and New York Assemblymember Harry Bronson gave opening remarks to kick off the showcase agenda. Our invited keynote speaker was Vaishali Kamat, the General Manager of New Ventures, Ultrasound Digital Solutions Teams at GE HealthCare. Vaishali is working with internal and external partners to bring novel AI solutions to GE HealthCare ultrasound products. The showcase also featured a town hall session that explored "Imaging in the Age of AI" and
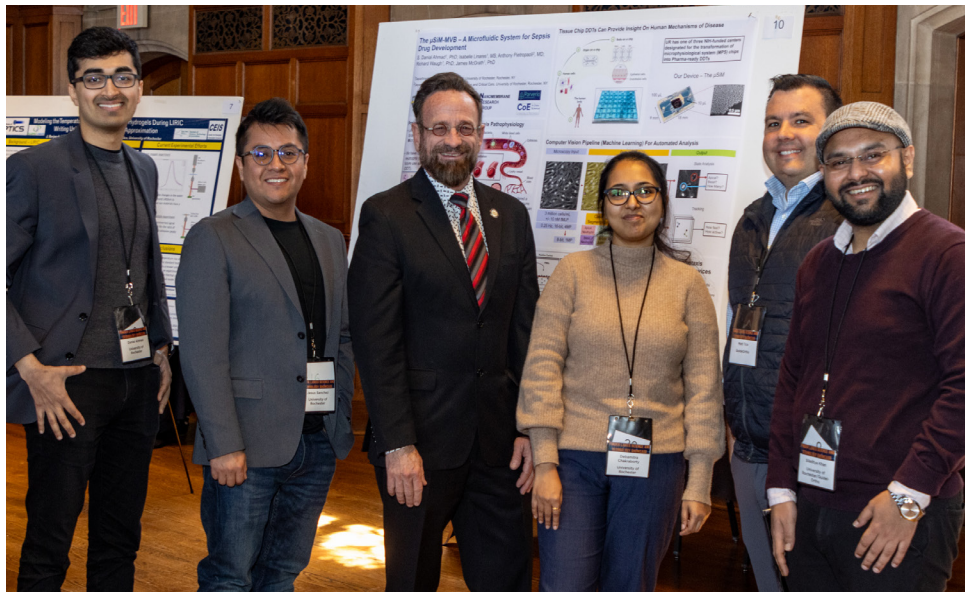
Assemblymember Harry Bronson chats with student presenters during the poster session.

was moderated by Terence Clas from Empire State Development with Paul Ballentine of CEIS and Jan Van Aardt of RIT's Center for Imaging Science.

The afternoon's agenda consisted of business and faculty networking pitches and a poster session. Representatives from six industry partners gave an overview of their company and six university faculty

were given the opportunity to present their research. The poster session featured thirty posters in the areas of AR/VR, biomedical technology, data science, high-performance computing, OPI, and sensors/acoustics/materials. Attendees voted on their favorite posters and posters by Haolin Lin, Adma Gama-Krummel, and Ashrith Maisa were recognized as the top three.

Moderator for the town hall session, Terry Clas (left) with CEIS's Paul Ballentine (center) and RIT's Jan Van Aardt (right).

Poster session and exhibitors set up in the Ballroom(top three photos)

Bottom left, keynote speaker Vaishali Kama from GE HealthCare

Bottom right, attendees participating during the Q&A portion of the keynote.

Photo credits for showcase event photos: Ria Tafani Photography

OTHER **CEIS INITIATIVES**

'THE IMAGING CAPITOL OF THE WORLD' A CENTER IN INTELLIGENT IMAGING

CEIS team members Paul Ballentine (third from left) and Dan Newman (far right) discuss the National Center in Intelligent Imaging initiative with Ben Verschueren, NYSTAR Executive Director (far left), and another attendee during the 2024 New York State Innovation Summit in Syracuse, New York.

This past year, CEIS and the UR Center of Excellence in Data Science joined forces to launch an initiative to make Rochester and the rest of New York a world leader in Intelligent Imaging - the application of AI to imaging. This initiative is a collaborative effort with the RIT Chester F. Carlson Center for Imaging Science, L3Harris Space and Airborne Systems Division, and GE Healthcare, with the support of NYSTAR.

Artificial intelligence is revolutionizing the world of imaging. AI is changing the way images are captured or generated, processed, analyzed, interpreted, and utilized. Intelligent imaging is being used in all sectors of the economy including healthcare, defense, manufacturing, agriculture, transportation and retail. In healthcare for example, AI is significantly advancing radiology by providing faster and more accurate diagnostics, enabling quality radiology in underserved areas that lack access to radiologists. In defense, AI is being combined with satellite imaging to

enable vast amounts of data to be analyzed and turned into actionable information without the need for humans in the loop. And in manufacturing, intelligent imaging has become critical in controlling the semiconductor manufacturing process.

The potential market for intelligent imaging systems and solutions is immense. The market size for intelligent imaging in healthcare alone is expected to exceed $25 billion by 2030.

Rochester and the rest of the state are positioned to be a leader in intelligent imaging. Both the University of Rochester and RIT have significant programs in imaging and AI. The University of Rochester houses several departments and programs that provide education and conduct leading edge research in both imaging and AI. These include the Electrical and Computer Engineering Department, the Computer Science Department, the Institute of Optics, Biomedical Engineering, and the Goergen Institute for Data Science. CEIS

and the CoE in Data Science both provide funding from NYSTAR for research in AI and imaging. This underscores the State's commitment to Intelligent Imaging. The UR Medical Center has a large Imaging Science Department that conducts clinical services, education, and research. At RIT, the Chester Carlson Center for Imaging Science ` is a unique interdisciplinary program dedicated to producing the next generation of researchers and innovators to apply imaging science in research, environmental service, artificial intelligence, aerospace, and national security. Between UR and RIT there are over 100 faculty and researchers developing imaging technologies with another 100, including radiologists, that use imaging in their work. There are over 300 undergraduate and graduate students majoring or minoring in fields related to intelligent imaging. Across the state, Cornell, Columbia, and SUNY Buffalo also have programs in which imaging and AI converge.

In the defense sector, Rochester is the headquarters for the L3Harris Space and Airborne Systems Division, a Kodak offshoot and the leading provider of geospatial intelligence technology to the Department of Defense. In healthcare, URMC has one of the largest medical imaging departments in the state and conducts over 900,000 imaging examinations per year. Carestream, another offshoot of Kodak, is a leading provider of medical and dental digital imaging systems. And there are many small and medium sized companies developing medical imaging technologies. In total, Rochester has over 30 small and medium companies providing AI and imaging

products. Across the state there are at least 70 companies that provide imaging technologies, including GE Healthcare, the largest provider of medical imaging equipment in the world.

CEIS and our partners are pursuing several parallel paths to make Rochester and New York State a leader in intelligent imaging. Starting locally, we have hosted various events including panel sessions, seminars, and town hall meetings to raise awareness of the opportunities. At the state level CEIS and the CoE in Data Science have launched the New York Intelligent Imaging Partnership, meant to increase collaboration between companies and academia. Another major part of the initiative is establishing a National Center for Intelligent Imaging. This National Center will enable major long-term collaborations between industry, academia and the government to develop trustworthy intelligent imaging methods. Importantly, the NCII will push those advances toward products and applications that will improve the efficiency and accuracy of image analytics, from medical to defense applications. A major focus of the NCII will be to educate the next generation of experts in intelligent imaging and provide continuing education for imaging experts and AI experts to learn more about intelligent imaging.

Panel Speakers address attendees during the February 2024 Intelligent Imaging event hosted by CEIS and the CoE in Data Science. Seated from the left to right, Dr. Mujat Cetin, Dr. Nebojsa Duric, Dr. Bob Fiete, Dr. Eli Saber, and Dr. Jiebo Luo. Standing at the podium is Dr. Paul Ballentine.

THE SOUNDTRAX FILM MUSIC AND SOUND FESTIVAL
BUILDING ON ROCHESTER'S LEGACY IN IMAGING AND MEDIA INNOVATION

Renowned as the imaging capital of the world and the birthplace of modern photography and film—Rochester is set to host the inaugural SoundtraX Film Music and Sound Festival on October 16–18, 2025. This groundbreaking event celebrates the art, craft, and technology of music and sound in visual media, shining a spotlight on Rochester's historical, cultural, and commercial ties to film, television, gaming, and the music industries.

The festival's story begins in 1921, when a generous donation from George Eastman, founder of Kodak and a visionary philanthropist, enabled the establishment of the University of Rochester's Eastman School of Music. In addition to enhancing the quality of life of the residents of Rochester through the arts, another aim was to support the growing silent film industry, which relied on skilled organists to accompany motion pictures. More than a century later, the SoundtraX Festival honors this legacy by exploring the transformative role of music and sound in visual storytelling, from its historical foundations to its cutting-edge innovations.

SoundtraX will provide a dynamic platform for industry professionals, musicians, academics, and enthusiasts to engage through presentations, discussions, workshops, and performances that showcase the fusion of art and technology in immersive audio-visual media. A central goal of the festival is to attract major industry players to Rochester, fostering deeper connections and partnerships with the Rochester region's burgeoning cluster of more than 20 audio technology and media production companies.

This collaborative effort, spearheaded by CEIS and the University of Rochester's Eastman School of Music in collaboration with the New York State and Finger Lakes Film Commissions, the George Eastman Museum, and with a grant from the NYS Market New York Tourism Grant Program, aspires to position Rochester as a global hub for innovation in music and sound for film, television, gaming, and related media.

The SoundtraX Film Music and Sound Festival will be a celebration of Rochester's past achievements and an investment in the future of contemporary media. By building on Rochester's rich legacy in imaging, CEIS and its partners aim to shape the next chapter of innovation in music and sound for visual storytelling.

NEW TEAM MEMBER JOINS CEIS

We are excited to welcome J. Daniel Newman to the CEIS team! Dan is a renowned imaging scientist whose distinguished career spans more than 35 years at iconic organizations including Kodak, ITT, Exelis, Harris Corp. and L3Harris. Over the years, Dan has been a outstanding industry collaborator with CEIS, leading several impactful programs that advanced imaging science and technology in meaningful ways. Following Dan's recent retirement from L3Harris, he brings his wealth of experience, creativity, and deep industry knowledge to CEIS. Already, he is playing a pivotal role in our efforts to establish Rochester as the home of a national center for intelligent imaging, consolidating the region's unmatched legacy in optics and imaging with emerging technologies in artificial intelligence. We are excited to have Dan on board and look forward to the innovation and insight he will continue to bring to our organization. Welcome to CEIS, Dan!
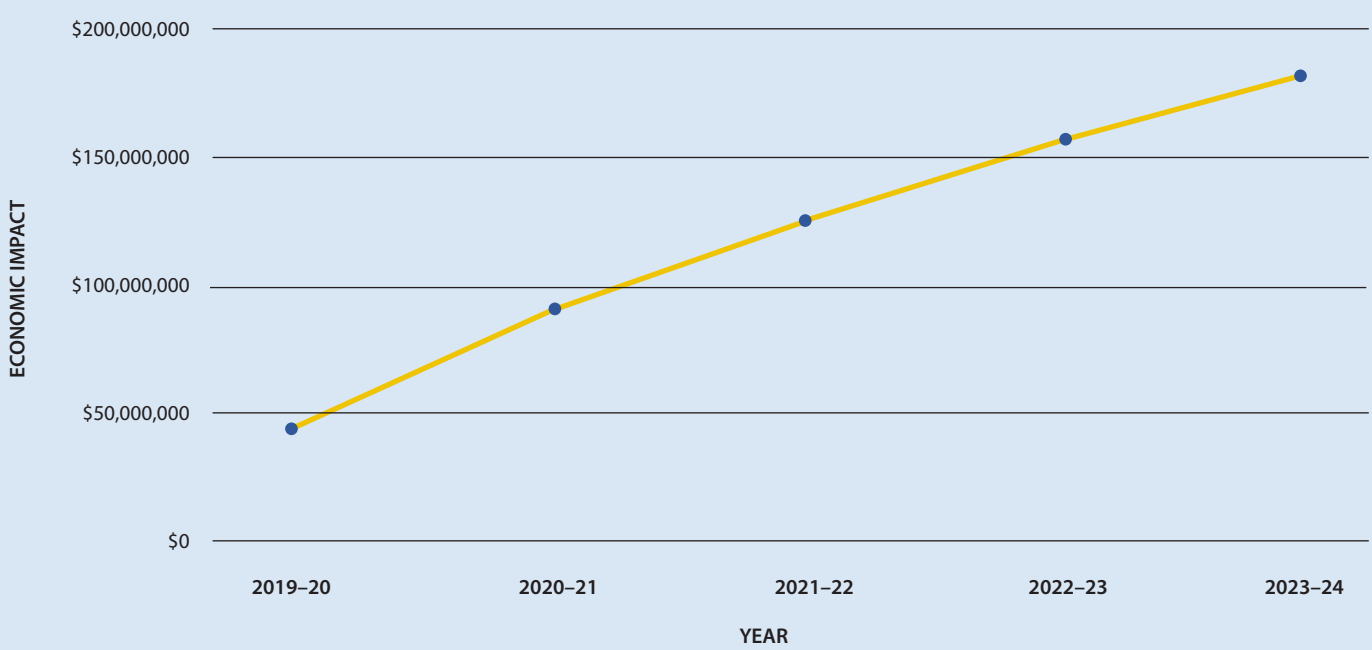
ECONOMIC IMPACT **2023–2024**

For the fiscal year July 1, 2023 to June 30, 2024, the total documented dollar value of the economic impact of CEIS supported research and outreach was over $27 million. This self reported data (new and retained jobs, increased sales, cost savings, capital investments and additional funds acquired) from 13 of our partners provides a snapshot of the region's economic successes. The five-year cumulative economic impact effect of CEIS investments in NYS entities is nearly $182 million.

A shout out to the AIM Photonics initiative which led the way with 7 new jobs along with reporting nearly $22 million in monetary impacts. And hats off to Phlotonics, a UR spinout companywith links to CEIS, the CoE in Data Science, NextCorps, and FuzeHub, with 5 new and 2 retained jobs reported.

FIVE-YEAR SUMMARY OF ECONOMIC IMPACT

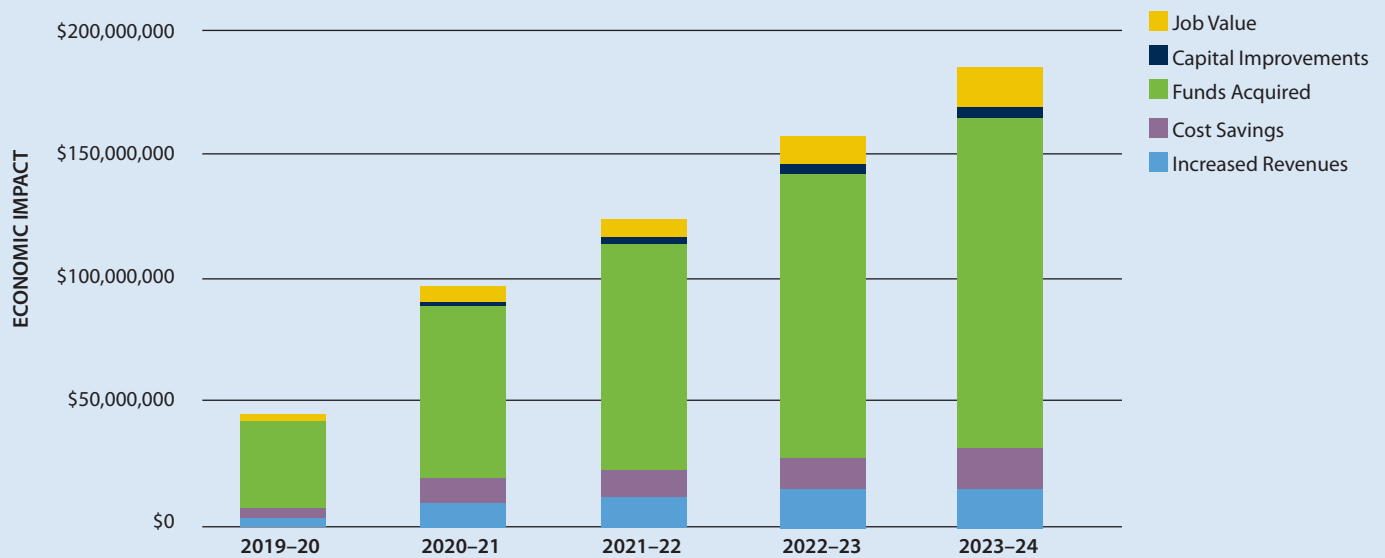| Year	2019–20	2020–21	2021–22	2022–23	2023–24	Total
Increased Revenues	$1,916,467	$4,051,507	$3,972,963	$2,317,144	$708,530	$12,966,611
Cost Savings	$2,807,309	$5,143,669	$2,931,593	$2,194,750	$1,834,600	$14,911,921
Funds Acquired	$37,067,808	$37,205,718	$22,700,043	$22,194,899	$23,360,577	$142,529,045
Capital Improvements	$53,000	$720,000	$80,000	$925,000	$100,000	$1,878,000
Job Value	$2,226,413	$2,308,974	$1,234,327	$2,528,410	$1,393,489	$9,691,613
New Jobs	20.25	17	11	31	16	95
Retained Jobs	14	18	9	10	6	57
Total Impact	$44,070,997	$49,429,868	$30,918,926	$30,160,203	$27,397,196	$181,977,190
Total Cumulative Impact	$44,070,997	$93,500,865	$124,419,791	$154,579,994	$181,977,190	$181,977,190

TOTAL CUMULATIVE ECONOMIC IMPACT

FIVE–YEAR ECONOMIC IMPACT

Legend:
- Job Value
- Capital Improvements
- Funds Acquired
- Cost Savings
- Increased Revenues

Y-axis: ECONOMIC IMPACT ($0 to $200,000,000)
X-axis: 2019–20, 2020–21, 2021–22, 2022–23, 2023–24

CAT PROGRAM FINANCIAL INFORMATION

July 1, 2023–June 30, 2024

FUNDING FROM NYSTAR

Personnel Related	
Research and Center Management	$655,423
Non-Personnel Related	
Research and Center Management	$256,161
Total NYSTAR Contribution	$911,585

OTHER SOURCES OF FUNDS—Cash from Companies

Personnel Related	$280,023
Non-Personnel Related	$131,193
Total Other Resources	$411,216

COMPANIES REPORTING ECONOMIC IMPACT IN 2023–24 FROM CEIS INTERACTIONS

AIM Photonics NNMI	Phlotonics
Aktiwave, LLC	POSPEA
Clerio Vision, Inc.	Power2Peer
Corning, Inc.	SiMPore, Inc.
Kitware	Thermo Fisher Scientific
L3Harris Technologies	VisualDx
LighTopTech Corporation	

New York has hundreds of optics, photonics, and imaging companies clustered into active regional collaborations. These regions are home to abundant organizations and companies that can deliver complete R&D, engineering, and manufacturing capabilities, providing entrepreneurial vision combined with next-edge research. This map shows the entities—from public and private universities to corporations and governmental agencies—involved in the New York Photonics initiative.

Photo credit: J. Adam Fenster, University of Rochester

Biomedical engineering PhD student Katie Daniel loads photonic sensor chips into a printer to be functionalized with capture molecules in the lab of Professor Benjamin Miller.

Modeling, characterization, and functionalizing material surfaces
Chunlei Guo
University of Rochester
AlchLight LLC

The Guo lab will work with AlchLight on developing machine learning and surface characterization for laser surface nanopatterning. The project will focus on developing machine learning in searching for optimal processing parameters, which can speed up the parameter search speed from weeks to hours; characterizing optical property and surface morphology for metal and glass samples, which will be used to feedback machine learning.

Material characterization and modeling
Chunlei Guo
University of Rochester
AlchLight LLC

AlchLight is developing a laser-assisted binding technology that will integrate ultra-high temperature resistant materials. The Guo lab will provide crucial characterization on the fabricated samples by AlchLight, including the topographical, morphological, compositional, oxidation resistance, and mechanical properties of AlchLight's samples. Additionally, the UR team will perform theoretical simulations on the relevant material behaviors.

A Tool for the Assessment of the Toxicity and Permeability of Drugs to the Human Outer Blood Retinal Barrier
James McGrath
University of Rochester
Bausch + Lomb

The loss of outer-blood-retinal-barrier (OBRB) function is a hallmark of prevalent retinal diseases including age-related macular degeneration and diabetic retinopathy. Because drugs targeting retinal diseases must penetrate the OBRB to reach the cells of the retina, pre-clinical models of the human OBRB are needed for ophthalmic drug development. Additionally, a number of commonly prescribed drugs exhibit retinal toxicity with chronic use. The fact that these drugs received FDA approval without safety concerns speaks to need for pre-clinical assays of retinal toxicity. We will address these unmet needs by creating and validating a model of the human OBRB 'on-a-chip'.

Research in support of high-manufacturing of custom ophthalmic devices
Wayne H. Knox
University of Rochester
Clerio Vision, Inc.

Research is proposed in three areas that could improve Clerio Vision's manufacturing processes. Using new advanced laser techniques, we will write 1D and 2D structures at high speeds using high energy low repetition rate lasers, and we will use newly developed phase profile writing to write multiple layers simultaneously. Furthermore, we will investigate new material processing conditions such as never-hydrated materials and new doping methods to increase photochemical stability and determine the thermal limits of damage and mechanical properties of various materials after LIRIC writing. Also proposed is a new method to write surface nanostructures for novel vision devices.

Analytical Model of a Dual-Ring Photonic-Integrated Tunable Laser
Drew Maywar
Rochester Institute of Technology
Eigenlabs, LLC

Eigenlabs, a small business founded in 2023, seeks to leverage photonic-integrated tunable lasers to explore new markets and economic opportunities. This project endeavors to deliver the deep understanding and design insight that would come from an analytical model encompassing the entire laser resonator.

Poolside: An Automated Poolside Chemical Balancing Machine
Daniel Phinney
University of Rochester
Hydrologic Systems LLC

This project aims to complete the integration of system hardware, firmware, the connection of the dispenser unit to the internet (via 4G LTE), and the creation of a backend server and client facing app.

Radio Audio via Surface Excitation
Michael Heilemann
University of Rochester
L3Harris Technologies | Communication Systems

We propose to explore the potential for surface excitation technology to enhance the performance and improve the durability of personal communication devices manufactured by L3Harris. New advances in flat-panel loudspeaker design will be leveraged to develop prototype radios that radiate and/or capture sound via surface vibrations. A point of emphasis will be the extent to which the existing sections of the radio can be used as the active surface, or if new form-factors are required to suit the new excitation methods. Different forms of excitation and sensing will be explored, including the use of thin piezoelectric elements.

Power generation from waste heat using a novel supercritical fluid Stirling engine
Eldred Chimowitz
University of Rochester
Millennium Engineering / Millennium Machinery

Thermal pollution represents a vast, largely untapped energy source due to its low temperature (<100 C). We propose investigating the use of a novel Stirling engine design using high pressure supercritical carbon dioxide as the engine's working fluid as a method to convert thermal energy into electrical energy. Our Thermodynamic calculations show the concept has significant potential for providing significant return of energy from a widely available unexploited resource.

X-Ray and UV Optics for Light-Source and Astronomical Applications

Zoran Ninkov
Rochester Institute of Technology
Optimax Systems, Inc.

This project's experimental goal is to develop digital micromirror devices (DMDs) that can be used as object-selection "slit generators" in the next generation of far ultraviolet (FUV) multi-object spectrometers (MOS). This work supports Optimax's strategic plan on entering the space instrumentation market.

Design and fabrication of on-chip lithium niobate microresonator devices

Qiang Lin
University of Rochester
POSPEA LLC

To design, fabricate, and characterize high-quality integrated photonic devices on thin-film lithium niobate platform, with a special focus on wafer-scale fabrication and manufacturing process. We have successfully improved the fabrication quality in the previous year of effort. We will continue along this line and focus on wafer-scale manufacturing.

Development of Protective Surface on Solid Patterned Nickel for Low Energy Cold Storage of Permanent Record Archives

Santosh K. Kurinec
Rochester Institute of Technology
Stamper Technology Inc.

This proposed research aims at developing and characterizing protective coatings on patterned nickel films obtained by maskless lithography and electroforming. Using a direct write lithography system, such as a maskless aligner, human readable archival records can be reduced and eventually recorded onto nickel films that can inherently last for thousands of years without degradation and withstand high fluctuation in temperature and humidity storage environments. This inert metal format would negate the need to strict adherence of NARA 1571 Environmental Storage standards for moisture barriers and HVAC regulation of humidity and temperature, saving thousands of dollars per month in cold storage costs for a business and billions for the archival industry.

Integration of Short-Wave Infrared (SWIR) Fabry-Perot Spectral Sensors

Elizabeth DeBartolo
Rochester Institute of Technology
Advanced Growing Resources, Inc.

A multidisciplinary design is required to enable existing short-wave infrared (SWIR) spectral detectors from Advanced Growing Resources' current sensor partner. A personality card, populated with the sensor and driver circuitry, must be designed and fabricated for compatibility with an existing processor baseboard. Updated firmware is also required for the new sensor architecture. The system must be validated with at least one of the three available SWIR sensors but would ideally function with all three.

Ultrafast-laser-based fabrication of glass waveguides toward integrated photonics

Jie Qiao
Rochester Institute of Technology
Aktiwave, LLC

This proposed project demonstrates ultrafast-laser-fabricated waveguides in glass materials. The influence of focal conditions and laser parameters on waveguide quality and geometry will be experimentally investigated via sensitivity studies. This innovation will enable the fabrication of low-loss optical waveguides for integrated photonic circuits with the integrated active and passive devices on the micron scale. It will provide weight, power and cost
reductions for telecommunications, advanced data centers, sensing, and free-space communications.

Research in Support of High Speed and Stable LIRIC Manufacturing Processes at Clerio Vision

Wayne H. Knox
University of Rochester
Clerio Vision, Inc.

Research is proposed in three areas that could improve Clerio Vision's manufacturing processes. Using new advanced laser techniques, we will write 1D and 2D structures at high speeds using high energy low repetition rate lasers, and we will use newly developed phase profile writing to write multiple layers simultaneously. Furthermore, we will investigate new material processing

conditions such as never-hydrated materials and new doping methods to increase photochemical stability and determine the thermal limits of damage and mechanical properties of various materials after LIRIC writing. Also proposed is a new method to write surface nanostructures for novel vision devices.

Innovation diligence in developing a system for remote detection of concealed weapons

Greg Gdowski
University of Rochester
Entry Point Technologies

Developing technology to detect guns from a distance at venue entrances is crucial for public safety and preventing mass shootings. It enables early threat detection, improves response time, enhances security measures, minimizes human error, and instills public confidence. While Entry Point Technologies (EPT) has taken the initiative to develop a thermal imaging system for concealed weapon detection, the current limitations surrounding its utilization necessitate further collaboration with the University of Rochester. The principal investigator aims to work closely with EPT to conduct diligence on gun detection methodologies, identify a path forward, and explore opportunities for greater collaboration.

Ultrasound Integrated Backscatter for Characterization of Tendon Microstructure

Diane Dalecki
University of Rochester
Imaginant, Inc.

Together, Imaginant and the Dalecki lab have begun advancing quantitative ultrasound for tissue characterization. The Dalecki lab developed imaging protocols and demonstrated experimentally that the angular dependence of the integrated backscatter coefficient (IBC) can be used to characterize collagen fiber microstructure noninvasively and nondestructively. Furthermore, these initial studies demonstrated the superior performance of the state-of-the-art, high-frequency ultrasound transducer and matched pulser received system designed by Imaginant specifically for quantitative imaging of collagen microstructure. Specifically, we will begin to translate our systems and methods toward a clinically relevant, load-bearing tendon, namely the Achilles tendon.

Pilot experiments toward elastographic microscopy in OCX™

Jannick Rolland
University of Rochester
LightTopTech Corporation

This proposal addresses the development of an optical coherence elastography (OCE) add-on for functional assessment of visco-elastic properties of tissue. OCX™, the imaging product launched by LightTopTech in 2021, combining optical coherence tomography (OCT) and optical coherence microscopy (OCM) for the first time in a single instrument, offers the opportunity to develop a multifunctional OCM/OCE system in a compact footprint. The dual-modality instrument will be used as a platform to investigate the impact of lateral resolution and field of view on OCE outputs. Given that no commercial OCE systems are available, there is a strong commercial opportunity to develop an elastography add-on module for the OCX™ product.

Photo credit: J. Adam Fenster, University of Rochester

A BIT OF FINE TUNING: Ultrasound research technician Sarah Raeman makes adjustments to an acoustic patterning apparatus in the laboratory of biomedical engineering professor Diane Dalecki.

Optical Phased Array for Adaptive Free-Space Optical Imaging and Communication
Hui Wu
University of Rochester
L3Harris Technologies | Space & Airborne Systems

We propose to investigate integrated silicon photonic optical phased array (OPA) technologies and develop a new free-space optical (FSO) imaging and communication system to meet the challenges facing conventional FSO systems. We seek to leverage silicon photonic devices; 3D integration; and supporting optics, circuits, and software to develop an OPA-based FSO system for adaptive free-space optical imaging and communication. One of the target applications is ad-hoc FSO communication links at distances up to tens of kilometers and with hundreds of nodes. We expect that the proposed research project will lead to technological breakthroughs for FSO imaging and communication and generate significant economic impacts in New York state and beyond.

Antibacterial surface treatment for pharmaceutical applications
Chunlei Guo
University of Rochester
Pfizer, Inc.

Pfizer is launching a new project to have the principal investigator's lab apply antibacterial surface technology to Pfizer's medical liquid drug and vaccine containers. Pharmaceutical equipment and devices require sanitation and antibacterial surfaces. Recently, the Guo lab at the University of Rochester demonstrated a technique to create sanitation and antibacterial surfaces on a range of materials with laser treatments. In this project, the Guo lab will apply the developed antibacterial technology on surfaces of Pfizer's pharmaceutical containers.

Robotics for Biosensor Assembly
Benjamin Miller
University of Rochester
Phlotonics, Inc..

Phlotonics, Inc. aims to utilize an Epson Pick-and-Place robotic module within the Miller Group for short-term feasibility studies on biosensor device assembly and placement. This will include initial machine setup, programming, and protocol development where individual photonic die will be selected and placed, within a 100 um tolerance, into a final assembly for assays. The output of this pilot effort will be transferred to a partner manufacturing facility in New York state for manufacturing scale-up. This will address an important manufacturing milestone for the company.

High-quality integrated photonic devices on thin film lithium niobate platform
Qiang Lin
University of Rochester
POSPEA, LLC

To design, fabricate, and characterize high-quality integrated photonic devices on thin-film lithium niobate platform, with a special focus on wafer-scale fabrication and manufacturing process.

Analysis of CO_2 emission reduction using solar photovoltaics and viability of carbon credits for distributed systems
Santosh Kurinec
Rochester Institute of Technology
Power2Peer, Inc..

In this research study, we propose to analyze CO2 emission reductions in using photovoltaics by analyzing exemplary residential rooftop PV systems. This will include emission in production and offsets in usage. Power2Peer is involved with the creation of a marketplace for accounting and marketing of the carbon credits generated by the distributed solar, wind, or geothermal systems. The carbon credits generated by the clean energy generation are assets that can be traded with the corporation seeking to offset generation of the fossil-fuel-based power with the clean energy. A technological solution that enables a marketplace for the growth of climate control by creating substantial incentive to generate clean energy needs to be established by a business case.

Dynamic Optical Return Loss from Optical-Fiber Arrays Under Vibration
Drew Maywar
Rochester Institute of Technology
RAM Photonics, LLC

Next-generation optical-fiber arrays solve communication-capacity issues at interfaces by packing multiple fibers into a small area. The automated manufacturing of such arrays is under development at RAM Photonics. A critical performance metric is the optical return loss (ORL), since reflected light can destabilize upstream optical sources. Although typically measured as a time-averaged quantity, ORL is expected to vary in time due to environmental vibrations, especially for communication systems used within marine, air, and land vehicles. We seek to demonstrate a time-resolved measurement of ORL and provide data to RAM Photonics to improve their fabrication process of optical-fiber arrays.

EV Display™ platform for detection of EV-associated proteins
James McGrath
University of Rochester
SiMPore, Inc.

SiMPore is currently commercializing an extracellular vesicle (EV) biomarker quantitation platform developed by the McGrath lab with prior support from a DOD Idea Award. The EV Display™ platform is being used in four laboratories for a wide range of practical applications. While SiMPore works to scale production and quality control of these devices, there is a demand for protocols that detect colocalization of multiple biomarkers on individual EVs and detection of rare EV biomarkers in complex biofluids. This proposal will develop solutions for detection of these biomarkers on EVs present in blood.
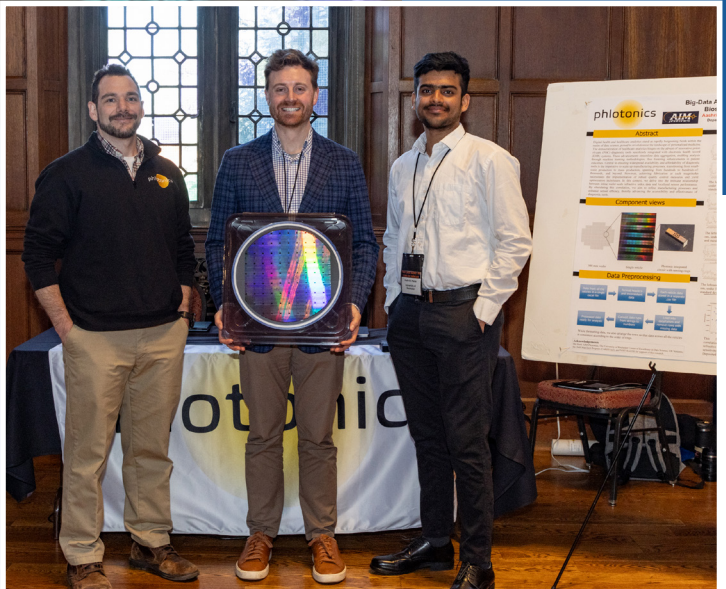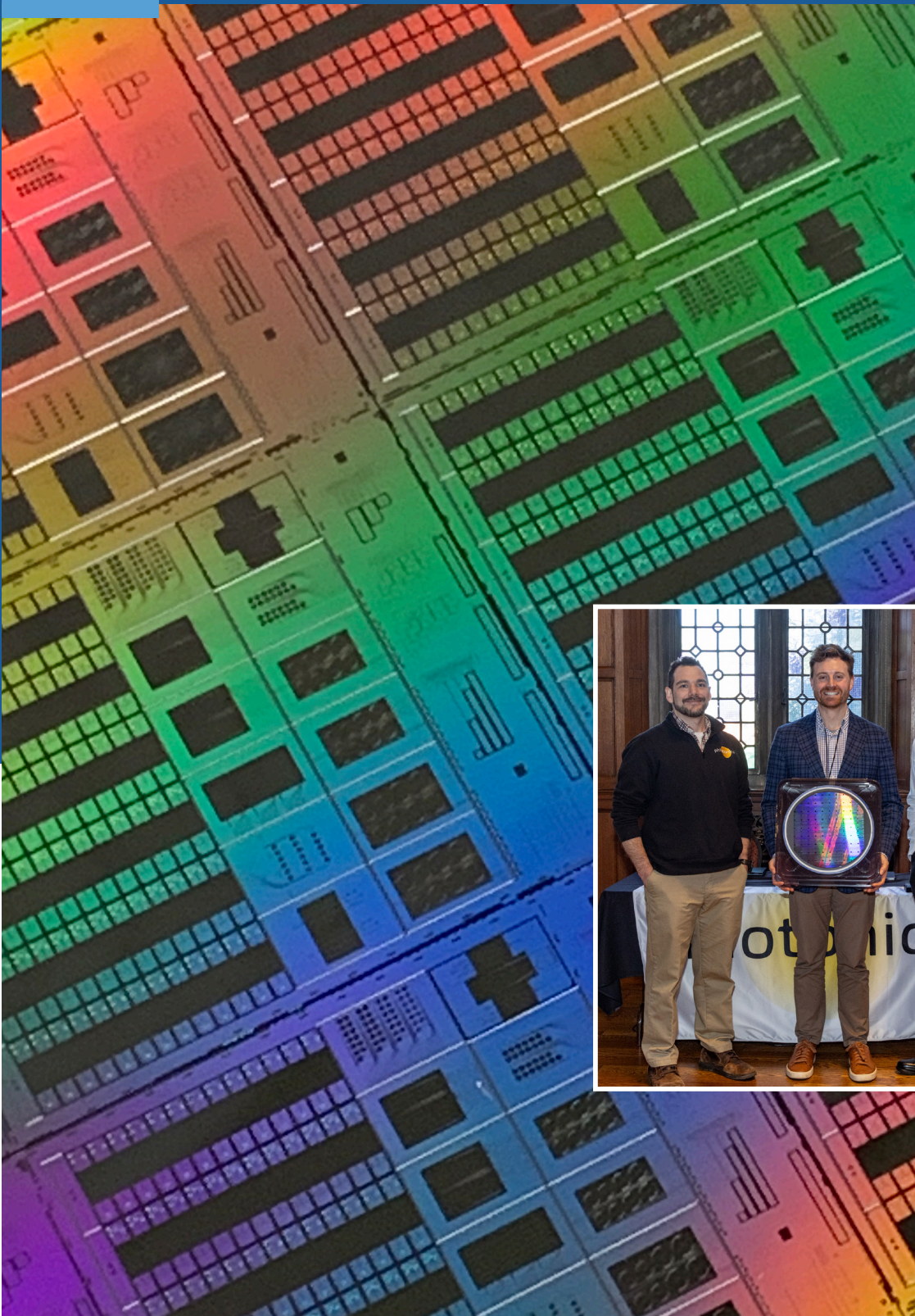
Above: Phlotonics, Inc. team exhibiting at 2024 Finger Lakes Science & Technology Showcase

Rochester researchers are developing an optical chip on a disposable card that can detect exposure to multiple viruses—including the coronavirus that causes COVID-19—within a minute and from a single drop of blood. (Courtesy of the Miller Lab)

ADVANCED GROWING RESOURCES INC.
www.agrsensors.com

At AGR®, we see the invisible® by bringing revolutionary optical sensing technology to the palm of your hand. We aim to remove guesswork from visual inspection with our proprietary optical scanning platform—Spectre®. AGR® is focused on the analysis of light frequencies, or "colors," that span beyond what the human eye can see to bring lab-grade material identification to the field. Spectroscopy, or frequency analysis, is only our first step toward changing the way everyday users harness the power of emerging optical technology.

AKTIWAVE LLC
www.aktiwave.com

Aktiwave LLC is dedicated to providing customized optical components and consulting services in optical technologies. Our beam shapers and coronagraphs have been used in a large variety of applications such as astronomy and laser engineering. We have experience in a wide range of domains such as optical system design and modeling, optical pulse diagnostic for ultrafast and telecommunication systems, spatial and temporal shaping, and intellectual property analysis.

ALCHLIGHT
www.alchlight.com

Alchlight, based in Rochester, New York, is the leading developer and distributor of advanced and proprietary laser-fabricated materials. Acclaimed by the New York Times as "optical alchemy," they use femtosecond laser processing to etch proprietary nanostructures on materials. Their procedure doesn't coat the materials; instead it changes the intrinsic properties of the materials. Their topographies can change the color of titanium to blue, make silicon attract water, or even make water bounce off brass.

ALLVAR ALLOYS
www.allvaralloys.com

ALLVAR was founded in 2014 and manufactures revolutionary metal alloys. The unique negative thermal expansion of these alloys helps compensate for and eliminate the detrimental effects thermal expansion has in a variety of applications. Negative thermal expansion alloys can be used to athermalize optic designs, reduce thermal stress in assemblies, maintain a constant force load, and maintain thermal stability. We currently offer our negative expansion alloys in bar (up to 2.25" round) and tube (up to 3.00" OD), depending on wall thickness. We also offer thermal compensating washers and spacers to maintain constant preloads to control the margin of safety of bolted joints. These negative thermal expansion washers and spacers are available as Type B washers and in custom sizes.

BAUSCH AND LOMB
www.bausch.com

Bausch and Lomb offer one of the world's most comprehensive portfolios of eye health products. B+L markets five broad categories of products: contact lenses, lens care, pharmaceuticals, cataract and vitreoretinal surgery, and refractive surgery.

CARESTREAM
www.carestream.com

Carestream is a dynamic, global company with more than 100 years of leadership. In today's rapidly changing global health care environment, where the mandate to provide better outcomes has never been greater, we add value by delivering personalized, affordable, and practical options to help our customers advance. Medical providers large and small, from clinics and single hospitals to large networks and even entire countries, are upgrading their radiology and IT systems using our latest solutions.

CORPORATE PARTNERS

CLERIO VISION, INC.
www.cleriovision.com

Clerio Vision is developing a novel vision correction procedure based on technology licensed from the University of Rochester. Instead of changing the shape of the cornea, as current LASIK-based approaches do, its approach is to use a femtosecond laser to change the refractive index of the cornea with small pulses to "write" a corrective prescription onto the cornea noninvasively. Because this approach doesn't thin the cornea, it can be repeated as needed to correct vision changes over a person's lifetime. The approach, called LIRIC, is being commercialized by some of the original architects of the world's first LASIK systems. Clerio's core technology has been in development for over a decade and is based on more than 40 issued and pending patents.

CORNING, INC.
www.corning.com

Corning, Inc. is a diversified technology company that develops breakthrough technologies that significantly improve people's lives. Corning pursues innovation and focuses on high-impact growth opportunities in the telecommunications, flat panel display, environmental, life sciences, and semiconductor industries.

DINAMICOR
www.dinamicor.com

DinamicOR is a medical equipment manufacturer whose mission is to standardize operating room organization with an ergonomic and intuitive Workflow Management System—improving the efficiency and reproducibility of surgical processes, which will enable perioperative staff to focus on providing thoughtful patient care.

EIGENLABS, LLC
www. eigenlabsllc.com

Eigenlabs LLC is a research and development firm experienced in the mathematical modeling, prototyping, and system integration of lasers, integrated-photonics, free-space optics, and signal-processing solutions for communication and sensing applications. We provide our clients with a deep physical understanding of fundamental principles informing and guiding design considerations early in the engineering development cycle. Our modeling, data aggregation & analysis, and prototyping capabilities ultimately leads to effective technology transitions and stronger solutions for the end customer.

HYDROLOGIC SYSTEMS, LLC
www. hydrologicpools.com

Hydrologic Systems LLC make industrial-grade water treatment techniques available to small-scale water treatment operations, including pool water treatment. We are at the dawn of the 4th industrial revolution, which reflects the age of blurred boundaries between cyber and physical systems, but this is not yet evident in small-scale water treatment, most of which is still manually maintained. Hydrologic Systems LLC seeks to combine industrial-grade machine control and remote monitoring and to borrow technologies from other industries to reduce waste streams and energy use.

KITWARE, INC.
www.kitware.com

Kitware, Inc. is a leader in the creation and support of open-source software and state-of-the-art technology. Through our long-standing commitment to open source, detailed in our open source mission statement, we have become one of the fastest growing software companies in the country. By fostering extended, collaborative communities, Kitware is able to provide flexible, cost-effective visualization, computer vision, medical imaging, data publishing, and quality software process solutions to a variety of academic and government institutions and private corporations worldwide.

L3HARRIS TECHNOLOGIES
www.l3harris.com

L3Harris Technologies is an agile global aerospace and defense technology innovator, delivering end-to-end solutions that meet customers' mission-critical needs. We provide advanced defense and commercial technologies across air, land, sea, space, and cyber domains. We bring speed, innovation, and flawless execution together with our commitment to make the world safer and more secure.

L&C ORTHOPEDIC & INNOVATION (LCOI)
www.lcorthopedicsinnovation.com

L&C Orthopedics & Innovation was founded in 2016 with a focus in bio-mechanical analysis of individuals in the orthopedics and sports performance world. Our goal is to use automated software to guide rehabilitation, prevent injuries, and improve sports performance to benefit individuals and clinics.

LIGHTOPTECH
www.lightoptech.com

LighTopTech Corporation is a women-owned optical technology company founded in 2013 and based in Rochester, New York. Our goal is to build innovative optical instruments to improve noninvasive imaging in medical and manufacturing fields.

MILLENNIUM MACHINERY
www. www.millenniummachinery.com

Millennium Machinery serves as a machine tool distributor, representing several retailers including Mitsubishi, System 3R, Ebbco, and more. In fact, we are the exclusive Mitsubishi distributor in 11 states, from Maine to Delaware. Millennium still specializes in EDM machines but has grown to include high-quality laser, press brake, sinker, waterjet, milling, and grinding machines as well. We also have an in-house fixture machine shop dedicated to building work-holding fixtures.

OPTIMAX SYSTEMS, INC.
www.optimaxsi.com

Founded in 1991, Optimax continues to enhance its unique capabilities for fast, reliable delivery of precision optics with superior quality and service, enabling customer success and employee prosperity. We leverage our optics manufacturing technology for programs that benefit mankind and projects that defend our freedom. Our know-how, innovation, and speed enable quicker production of precision optics to meet emerging market needs. Some of the most sophisticated programs in the world trust Optimax to produce the most complex optics reliably.

OPTIPRO SYSTEMS, LLC
www.optipro.com

OptiPro was founded on one revolutionary, yet simple, concept: optical fabricators deserve more. In the past 30 years since we introduced the first affordable CNC machine designed specifically for the optics industry, we have consistently built a culture that cares—a culture of employees who live and breathe by our strong OptiPro values and a culture of best-in-breed customers who are collectively on a relentless pursuit of process efficiencies, design improvements, capability enhancements, and marketplace superiority.

CORPORATE PARTNERS

OVITZ
www.o-vitz.com

Ovitz Corporation is an exciting medical device company specializing in developing, manufacturing, and marketing novel and portable ophthalmic equipment and accessories that facilitate the delivery of ophthalmic care in eye doctors' and primary care physicians' offices and in schools, rural areas, and developing nations.

PARVERIO INC.
www.parverio.com

Parverio was founded to address the rising containment known as microplastics. With our revolutionary technology, we aim to bring microplastic testing and awareness to concerned individuals everywhere.

PFIZER INC.
www.pfizer.com

Pfizer Inc. is an American multinational pharmaceutical and biotechnology corporation in relentless pursuit of breakthroughs that change patients' lives. We innovate every day to make the world a healthier place. It was Charles Pfizer's vision at the beginning and it holds true today.

PHLOTONICS, INC.
www.phlotonics.com

Phlotonics designs integrated photonics for point-of-care diagnostics. This technology integrates photonic sensors with microphysiological systems for research and drug development.

POSPEA, LLC
www.pospea.com

POSPEA is dedicated to developing narrow linewidth, broadband tuning lasers and aims to fill the need of LiDAR and 3-D display used on robotics and self-driving cars. Functionalities of nanophotonic devices/circuits rely crucially on the properties of underlying device materials. We explore new material platforms with outstanding characteristics (electrical, optical, mechanical, thermal, etc.) for diverse applications, with specific focus currently on lithium niobate.

POWER2PEER, INC
www.power2peer.com

Power2Peer is leading the charge to a greener future. Founded in 2018 by veteran innovator Dr. Nish Sonwalkar (MIT), our diverse staff has decades of experience in clean energy innovation, software design, and systems management. Our team of experts developed a platform that makes it easier than ever for solar and other renewable energy sources to take hold of the market. By enhancing returns on capital investments in renewable energy while simultaneously reducing energy costs for consumers in the clean energy marketplace, Power2Peer is providing a market-oriented solution to the looming climate crisis.

QUIDELORTHO
www.quidelortho.com

QuidelOrtho stands at the forefront of testing, tracking, and disease analysis of health conditions ranging from HIV and hepatitis C to flu, strep and COVID-19. For decades, our precision and accuracy have guided clinicians and lab technicians in the moments that matter most. We envision a world where individuals, families and communities have the insight and clarity to spot trends sooner, respond quicker and confidently chart their course to better health.

RAM PHOTONICS, LLC
www.ramphotonics.com

RAM Photonics, LLC, was founded in 2009 for the express purpose of transitioning high-risk technology into commercial hardware. The company portfolio includes specialty optical and optoelectronic systems for defense, commercial, and industrial applications, including advanced signal processing, high-power laser, and instrumentation systems. Our company focuses on translational R&D, developing commercial-grade modules for technical risk reduction and technology demonstrations, intellectual property directly coupled with targeted technologies, and robust and reliable commercial hardware for sale to the general public.

SIMPORE, INC.
www.simpore.com

SiMPore is a Rochester, New York–based nanotechnology company that designs and produces membranes and membrane-enabled products based on its unique patent-pending platform technology—the NanoBarrier™ ultrathin nanoporous silicon membrane. The NanoBarrier™ membrane is the world's first membrane to offer both tunable nanometer-scale thickness and pore size. SiMPore is developing products that take advantage of these one-of-a-kind features, including filters for separating and concentrating biological molecules and nanoparticles, cell culture substrates for growing cells, and electron microscopy grids for preparing and imaging samples at the nanoscale.
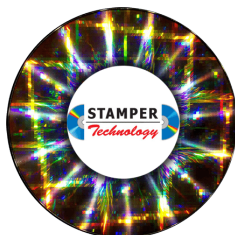
STAMPER TECHNOLOGY
www.stampertech.com

Stamper Technology works everyday with executives of archival foundations to archive knowledge of Earth permanently for future generations. We have archived a 30 million page library on the Moon as well as ancient texts for the Buddhists and the Argentina government. At Stamper Technology we're not only scientists, but we're also artists. We preserve legacies forever in a nano-format that can easily be stored, carried, or even worn. Everyone has a story and collectively those stories make history and comprise a legacy for humanity. We share those stories and find comfort in them. We all have stories of our faith, our country, our heroes, our knowledge of math and science, our arts and music, our family, and our passion.

SUNDENSITY, INC.
www.sundensity.net

SunDensity Inc. produces photonic smart coatings (PSC) for utility solar power producers who need to reduce the cost of energy. Their nano-optical coating improves PV efficiency by downshifting UV rays for greater power output from solar modules, thus lowering overall power costs and accelerating solar energy adoption into the next generation of clean power.

THERMO FISHER SCIENTIFIC, INC.
www.thermofisher.com

Thermo Fisher Scientific Inc. is the world leader in serving science, with revenues of $17 billion and 50,000 employees in 50 countries. Our mission is to enable our customers to make the world healthier, cleaner, and safer. We help our customers accelerate life sciences research, solve complex analytical challenges, improve patient diagnostics, and increase laboratory productivity. We offer an unmatched combination of innovative technologies, purchasing convenience, and comprehensive support.

VISUALDX
www.visualdx.com

When unsure of a diagnosis, VisualDx is the go-to tool for fast, accurate decision making. Quickly build a differential to evaluate the possibilities, compare variations, and improve diagnostic accuracy at the point of care. VisualDx is the leader in clinical decision support, used in more than 1,500 hospitals and institutions and more than 50 percent of U.S. medical schools. Trusted by physicians and nurses all over the world, VisualDx is utilized across several professional specialties.
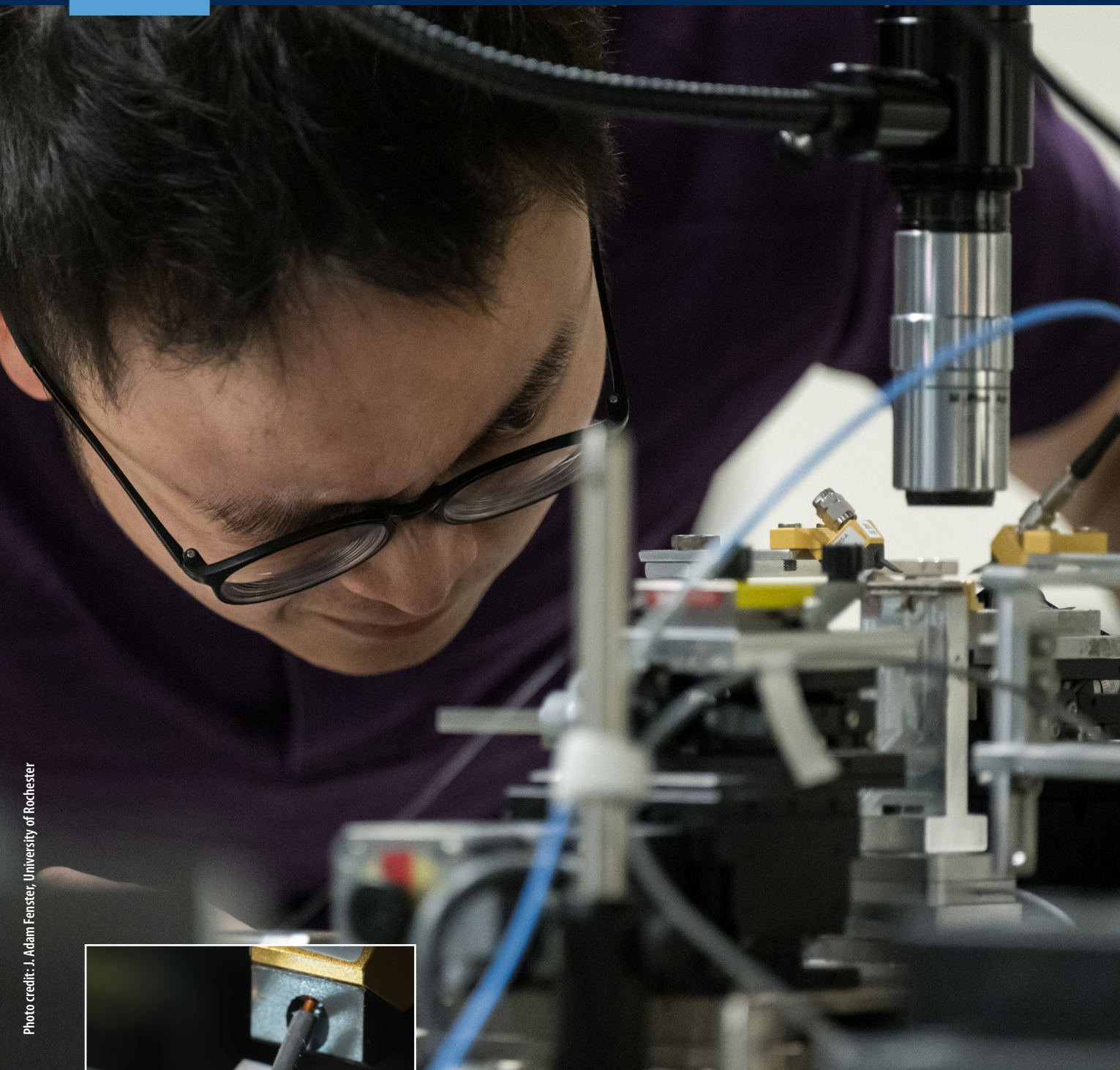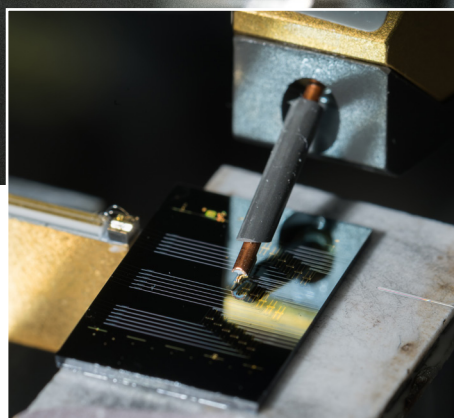
Electrical and computer engineering PhD student Zhengdong Gao adjusts a new "all in one" microcomb laser device created in the lab of professor Qiang Lin.

GOVIND AGRAWAL

James C. Wyant Professor of Optics, Professor of Physics, and Distinguished Scientist at the Laboratory for Laser Energetics, University of Rochester

Education PhD, Indian Institute of Technology, Physics, 1974; MS, Indian Institute of Technology, Physics, 1971; BS University of Lucknow, Physics and Statistics, 1969

Research Interests Quantum electronics, Nonlinear photonics, Fiber-optic communications

Recent Research Projects Transmission of optical pulses, Semiconductor lasers, Nonlinear fiber optics, Optical communications

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THOMAS BROWN

Mercer Brugler Distinguished Teaching Professor, Professor of Optics, and Director of the Institute of Optics, University of Rochester

Education PhD, University of Rochester, Optics, 1987; BS, Gordon College, Physics, 1979

Research Interests Optical polarization and metrology, Optoelectronic modeling Integrated optoelectronics

Recent Research Projects Adaptive Nulling for Steep Aspheres using a Holographic Reference Surface, Focusing and coherence properties of polarization vortex beams, Stress-engineered optical elements, Polarization properties of nanostructures, Waveguide mode resonances in SOI waveguides

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Education PhD, University of Rochester, Physics, 1984; MS, University of Rochester, Physics and Astronomy, 1980; BS, Colgate University, Physics and Astronomy, 1978

Research Interests Multimedia signal processing, Imaging microelectronics, Wireless sensors

Recent Research Projects Digital audio watermarking and steganography, Image sensors with built-in image compression, Digital CMOS image sensor read-out circuits

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Research Interests Photonic packaging, 2D materials, Integrated photonics, Nonlinear photonics, On-chip quantum photonics

Recent Research Projects Integrated optical frequency detection and weak value amplification, Fiber-to-chip fusion splicing for low-loss photonic packaging, Carrier envelope offset detection via simultaneous supercontinuum and second-harmonic generation in a silicon nitride waveguide, A reconfigurable nanophotonics platform for sub-millisecond, deep brain neural stimulation

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FACULTY RESEARCHERS

ELDRED CHIMOWITZ

Emeritus Professor of Chemical Engineering

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Research Interests Critical Phenomena, Supercritical Fluids, Percolation, Computer Simulation

Recent Research Projects Supercritical Waste Heat Recovery Processes for Power Generation, Complex Network Theory Applied to Power Distribution Systems

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Education PhD, University of Rochester, Electrical Engineering; MS, University of Rochester, Electrical Engineering; BS, University of Rochester, Chemical Engineering

Research Interests Diagnostic ultrasound imaging, Therapeutic applications of ultrasound, Low frequency underwater sound fields

Recent Research Projects Mechanisms for wound healing with ultrasound, Ultrasound technologies for tissue engineering, Effects of underwater sound on biological tissues

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Research Interests Mechanical behavior of novel materials, Diffusion-bonded high-temperature alloys, Polymers used in human tissue simulations

Recent Research Projects The TEAK Project: Students as Teachers, Terrain characterization using modified RANSAC analysis of human gait data, Minimum constraint design analysis and modification of a biaxial tensile test fixture for hyperelastic materials

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Research Interests Computer graphics, Digital imaging, Data visualization, Visual perception, Low vision, Assistive technologies

Recent Research Projects Effects of image dynamic range on apparent surface gloss

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Associate Dean for Education and New Initiatives, Professor of Mechanical Engineering and of Materials Science, University of Rochester

Education PhD, Michigan Technological University, Metallurgical Engineering, 1984; BS, Michigan Technological University, Metallurgical Engineering, 1979

Research Interests Relationships among microstructure, properties, and processing of materials

Recent Research Projects Refining and validating a model to characterize shape changes due to LIRIC writing on cornea, Optical probing for freeform optics metrology

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THOMAS GABORSKI

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Education PhD, University of Rochester, Biomedical Engineering, 2008; MS, University of Rochester, Biomedical Engineering, 2004; BS, Cornell University, Biological and Environmental Engineering, 2002

Research Interests Nanomaterials and membrane fabrication, Microfluidics, separations, and device design, Cellular biophysics, Quantitative fluorescence imaging

Recent Research Projects Cellular co-culture screening assays

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GREG T. GDOWSKI

Professor of Instruction, Biomedical Engineering, and Executive Director, Center for Medical Technology and Innovation, University of Rochester

Education PhD, Boston University, Biomedical Engineering, 1996; MS, Boston University, Biomedical Engineering, 1988; BS, Boston University, Biomedical Engineering, 1985

Research Interests Vestibulo-collic reflexes (VCR), Neural mechanisms underlying postural control, Vestibulo-spinal (VS) pathways

Recent Research Projects A testing platform to evaluate thermal profiles of balloon catheter-based bipolar radiofrequency ablation devices in the treatment of resistant hypertension, Photodynamic antimicrobial polymers for infection control

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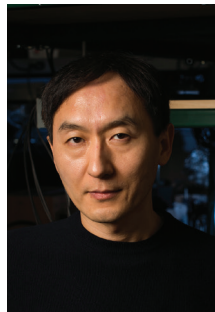
Professor of Optics and Senior Scientist in the Laboratory for Laser Energetics, University of Rochester

Education PhD, University of Connecticut, Physics, 1999; BS, Changchun Institute of Optics and Fine Mechanics, Physics, 1994

Research Interests Femtosecond laser-matter interactions at high intensities

Recent Research Projects Superwicking cooling devices for computer CPU and microelectronics

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FACULTY RESEARCHERS

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Education PhD, University of Rochester, Electrical Engineering, 2018; MS, University of Rochester, Electrical Engineering, 2015; BS, Canisius College, Physics, 2013

Research Interests Structural acoustics and vibration, Loudspeaker design, Audio signal processing perception, Spatial audio

Recent Research Projects Measures of vibrational localization on point-driven flat-panel loudspeakers, The evolution and design of flat-panel loudspeakers for audio reproduction, Near-field object-based audio rendering on flat-panel displays

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Education PhD, Massachusetts Institute of Technology, Electrical Engineering and Computer Science, 2000; MS, Massachusetts Institute of Technology, Electrical Engineering and Computer Science, 1997; BS, Cornell University, Electrical Engineering, 1995

Research Interests Multimedia communication, Wireless sensor networks, RFID systems, Cloud computing, Heterogeneous networking

Recent Research Projects Support for distributed computing and network management in mobile ad hoc networks, Developing RFID systems for inventory management, Designing a QoS-aware protocol architecture to support real-time multimedia data transmission, Optimizing video-based sensor networks

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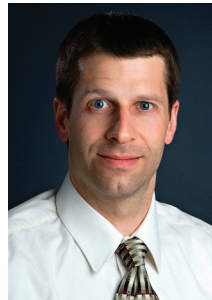
Professor of Microelectronic Engineering and Director of Semiconductor and Microsystems Fabrication Laboratory, Rochester Institute of Technology

Education PhD, University of Rochester, Electrical and Computer Engineering, 2000; MS, Rochester Institute of Technology, Electrical Engineering, 1992; BS, Rochester Institute of Technology, Microelectronic Engineering, 1990

Research Interests Silicon device integration on nontraditional substrates, Metal-oxide semiconductors for thin-film electronics, Silicon-based optoelectronics

Recent Research Projects MicroLED display technology development, Development and characterization of high-performance transistors on glass, Development of bipolar and MOS high-power microwave transistors

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Education PhD, Albany Medical College, Physiology, 1992; MS, Albany Medical College, Physiology, 1990; BS, Hartwick College, Medical Technology, 1983

Research Interests Extracellular matrix, Fibronectin

Recent Research Projects Extracellular matrix protein, fibronectin and wound repair, Tissue engineering, Therapy for tissue regeneration in chronic wounds

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KRYSTEL HUXLIN

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Education PhD, University of Sydney, Neuroscience, 1994; BS (Med), University of Sydney, Neuroscience, 1991

Research Interests Optics of the eye, Femtosecond laser micro-machining in cornea and lens, Visual perception and psychophysics, Biomedical imaging

Recent Research Projects Biological Impact of LIRIC in the cornea, Femtosecond laser micromachining, Effect of corneal wound healing on physiological optics of the eye, Perceptual learning with a damaged visual system

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Education PhD, Imaging Science, Rochester Institute of Technology, 2005; MS, Imaging Science, Rochester Institute of Technology, 1999; BS, Imaging Science, Rochester Institute of Technology, 1996; AAS, Optical Engineering, Monroe Community College, 1989

Research Interests Global surveillance augmentation for deep learning, Low-Light-Level (LLL) modeling, Incorporation of LiDAR and physics-based (target) modeling into structured hybrid hyperspectral sub-pixel detection algorithms with the addition of a geometric infeasibility metric

Recent Research Projects Global surveillance augmentation for deep learning, Atmospheric and radiative transfer modeling, Scattering from small particles related to bio-aerosols, Long-wave spectral variability, Remote sensing instrumentation and sensor calibration, Advanced atmospheric compensation, Spectral bi-directional reflectance (BRDF) measurements and modeling from objects such as vehicles

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Education PhD, University of Rochester, Electrical and Computer Engineering, 2004; MS, University of Rochester, Electrical and Computer Engineering, 2001; BS, University of Novi Sad, Electrical Engineering and Computer Science, 1999

Research Interests A/D conversion, CMOS analog circuits, Low power circuit architectures, Image sensors

Recent Research Projects Compressive beamforming for portable ultrasound, Developing and investigating focal plane compression techniques where majority of multiplication computations required by the compression are rendered unnecessary

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JOHN KEREKES

Research Professor in the Chester F. Carlson Center for Imaging Science, Rochester Institute of Technology

Education PhD, Purdue University, Electrical Engineering, 1989; MS, Purdue University, Electrical Engineering, 1986; BS, Purdue University, Electrical Engineering, 1983

Research Interests Remote sensing, system modeling and analysis, Pattern recognition, Digital Imaging, Image Processing

Recent Research Projects Global surveillance Augmentation for deep learning

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Education PhD, University of Rochester, Optics, 1984; BS, University of Rochester, Optics, 1979

Research Interests Ultrafast laser physics and prototyping, Femtosecond micromachining and applications in vision science, dispersion micromanagement in holey and photonic crystal fibers, Ultra-short pulse lasers, Novel fiber components based on fiber tapering, Dispersion compensation devices High nonlinearity fiber devices, Ultrafast mid-infrared sources, Dispersion—limits, measurements, compensation schemes, Biomedical optics

Recent Research Projects Multiphoton LIRIC: modeling, scaling, and material modification studies, Femtosecond micromachining of ophthalmic polymers

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SANTOSH KURINEC

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Education PhD, University of Delhi, Physics, M.S., University of Delhi, Physics, B.S., University of Delhi, Physics

Research Interests Magnetic Tunnelling and Phase Change Memory Devices, Silicon CMOS/MEMS, Photovoltaics, Nonvolatile Memory

Recent Research Projects A Comparative Study of n- and p-Channel FeFETs with Ferroelectric HZO Gate Dielectric, Introducing gallium in silicon and thin film polysilicon using self-assembled monolayer doping, Degradation Analysis of an Operating PV Module on a Farm Sanctuary

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Education PhD, Mechanical Engineering, University of Michigan, 1996; BS, Mechanical Engineering, University of Delaware, 1990; BS, Textile Science, Apparel Design, 1983

Research Interests Role of gender, obesity, ethnicity, activities, and meniscal injuries in the development of osteoarthritis, Using models based on medical imaging techniques such as micro-computed tomography and magnetic resonance

Recent Research Projects Refining and validating a model to characterize shape changes due to LIRIC writing on cornea, Biomechanical modeling of the human cornea, Characterizing growth of the knee joint, Finite element models of the knee meniscus, Knee flexion mechanics, Modeling vision correction with LIRIC writing modalities, MR imaging of musculoskeletal joints and bone properties, Understanding the risks for knee osteoarthritis
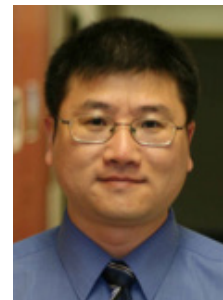
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Research Interests Fundamental physics of novel nonlinear optical, quantum optical, and optomechanical phenomena in micro-/nanoscopic photonic structures, Chip-scale photonic signal processing in both classical and quantum regimes

Recent Research Projects Perfect soliton crystals on demand, Athermal lithium niobate microresonator, Shallow-etched thin-film lithium niobate waveguides for highly efficient second-harmonic generation, Silicon carbide zipper photonic crystal optomechanical cavities
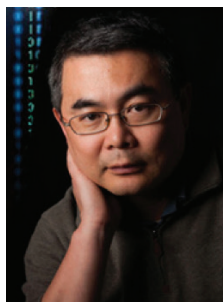
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Research Interests Computer vision, Machine learning, Social media, Data mining, Human computer interaction, Biomedical informatics, Mobile and pervasive computing, Computational photography, Ubiquitous and mobile computing

Recent Research Projects Fine-grained user profiling from multiple social multimedia platforms, Wine recommendation for grocery shoppers

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Research Interests Physical systems and industrial problems pertaining to flows of biological and complex fluids, Modeling, Ordinary and partial differential equations, Scientific computing
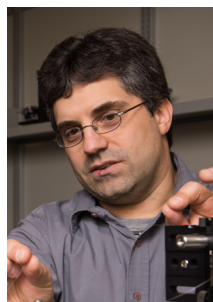
Recent Research Projects Improved mathematical modeling and computer simulation of contact lens dynamics, Effect of contact lens distortion on exchange of tears, Model for suction pressure under a contact lens

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Education PhD, University of Rochester, Optics, 1997; MS, University of Rochester, Optics 1992; BS, University of Illinois at Urbana–Champaign, Engineering Physics, 1991

Research Interests Large-mode area fibers, High-efficiency high-power fiber lasers and amplifiers, High-power ultrafast fiber lasers, Fiber lasers at exotics wavelengths, Brightness improvement of high-power semiconductor lasers, Power scaling/beam combining of fiber and semiconductor lasers

Recent Research Projects Review of ultrafast fiber oscillators based on Mamyshev and dissipative soliton resonance mechanisms, Observations of spatial coherence collapse in high-power, broad-area lasers using fiber-assisted self-heterodyning

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Education PhD, University of Salamanca, Physics, 1996; MS, University of Salamanca, Physics, 1992; BS, University of Salamanca

Research Interests Visual optics, Ocular imaging

Recent Research Projects Functional integration of eye tissues and refractive eye development mechanisms and pathways, Vision with spatial light modulator simulating multifocal contact lenses in an adaptive optics system, Simulating outcomes of cataract surgery: important advances in ophthalmology

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Research Interests Fiber-optic communication systems, Optical and photonic components, Optical phenomena and physical processes

Recent Research Projects Image processing for optical weld-joint failure protection, Avionic fiber-optic networks, Improved RF-signal propagation over fiber, Terabit-per-second fiber-optic system, Metamaterial distributed feedback lasers, All-optical data-wavelength converters, All-optical digital gates, Optical-domain RF spectrum analyzer, Nonlinear dynamics of polarization rotation, Time transformation, Adiabatic wavelength conversion, Self-phase modulation, Four-wave mixing

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Education PhD, Division of Health Sciences and Technology, Harvard/MIT, 1998; MS, Massachusetts Institute of Technology, Mechanical Engineering, 1994; BS, Arizona State University, Mechanical Engineering, 1991

Research Interests Nanoparticle and molecular separations, Nanotechnology, MEMS and micro fabrication, Cell culture technologies, Biological tissue models, Small format hemodialysis, Biosensors, Electrokinectic devices

Recent Research Projects Interaction of nanoparticles with cells and protein mixtures, Ultrathin silicon-based nanomembranes for filtration of molecules and nanoparticles, Ultrathin silicon-based nanomembranes for biological co-cultures

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Education PhD, University of Rochester, Electrical and Computer Engineering, 2002; MS, University of Rochester, Electrical and Computer Engineering, 1998; BS, University of Rochester, Electrical and Computer Engineering, 1996

Research Interests Use of motion-tracking techniques to enhance the contrast of ultrasound images, Acoustic radiation force impulse (ARFI), Magnetically induces vibration of brachytherapy seeds

Recent Research Projects Development of novel, clinically applicable ultrasound imaging techniques, Acoustic radiation force imaging techniques, Spatially modulated ultrasound radiation (SMURF) imaging, Single tracking location (STL), Shear wave elastography imaging (SWEI)

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Education PhD, Stanford University, Organic Chemistry, 1994; BS, Chemistry/BA, Mathematics, German, Miami University, 1988

Research Interests Biomedical nanotechnology, Combinatorial chemistry, Biophysical methods, Biosensors

Recent Research Projects Control of biomolecular interactions through the synthesis of new small-molecule probes and the observation of biomolecular interactions through the development of novel optical sensing technologies, In the area of control The AIR flu chip: A multiplex optical biosensor of influenza serology

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ZORAN NINKOV

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Education PhD, University of British Columbia, Geophysics and Astronomy , 1985; MSc, Monash University, Physical Chemistry, 1980; BSc, University of Western Australia, Physics, 1977

Research Interests Novel 2-D CMOS detector arrays, Fundamental limitations of visible and IR arrays, Miniaturized multispectral systems

Recent Research Projects Development of quantum dot coated detector arrays, Development of novel two-dimensional detector arrays, Development of image processing techniques for optimal analysis of such two-dimensional astronomical image data

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Education PhD, Electrical Engineering, Biomedical Concentration, Massachusetts Institute of Technology, 1981;MS, Electrical Engineering, Massachusetts Institute of Technology, 1978; BS, State University of New York at Buffalo, 1976

Research Interests Medical imaging, Image processing, Novel scanning techniques, Fundamentals of wave propagation with signal and image processing techniques
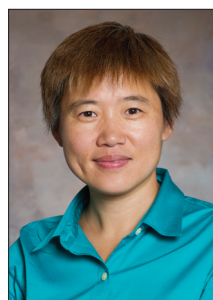
Recent Research Projects Techniques and methods for Gabor-domain optical coherence elastography, The blue noise mask, The development of sonoelastography, The development of crawling waves, Tissue biomechanics and the microchannel flow model, The H-scan for identification of scatterers, The reverberant shear wave fields, The needle pulse, OCT elastography, Enhanced resolution, Advanced 3D-4D analytics, The new view of tissue scattering

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Education PhD, Cornell University, Electrical and Computer Engineering, 2007; BS, Rochester Institute of Technology, Electrical Engineering, 2002

Research Interests Silicon photonics, Quantum optics

Recent Research Projects Integrated quantum photonics for photon-ion entanglement, System, device and method for aligning and attaching optical fibers, High extinction ratio microring modulator, Highly-confined, low-loss visible photonics using foundry-fabricated silicon nitride circuits

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Research Interests Optical metrology, Optical instrumentations, Adaptive and active optics, Segmented large-scale optics alignment and testing, Pulse compression, ultrafast laser systems and applications, Optical system design and performance evaluation

Recent Research Projects Femtosecond laser-based fabrication of photonic waveguides toward wavelength lasers, Development and investigation of an integrated laser-based optics polishing and manufacturing technology, Laser polishing for additive manufacturing

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FACULTY RESEARCHERS

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Research Interests Theoretical and application-oriented research topics covering several aspects within the fields of ergonomics, biomechanics, work physiology, safety, and rehabilitation

Recent Research Projects Lumbar time-varying muscle synergies in trunk flexion and bending movements at different velocities, A systematic review of fall risk factors in stroke survivors toward improved assessment platforms and protocols, Abstract TP61: Can a single motion sensor identify lower limb movement alterations among stroke survivors?

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Education PhD, University of Arizona, Optical Science, 1990; MA, University of Arizona, Optical Science, 1987; Diplôme Grandes Ecoles, Institut d'Optique (France), 1984

Research Interests Optical system design for imaging and non-imaging optics, Physics-based modeling, Image quality assessment

Recent Research Projects Techniques and methods for Gabor-domain optical coherence elastography, Gabor-domain optical coherence microscopy for detection of defects in manufacturing, Optical coherence tomography for quantification of contact lens properties

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Education PhD, North Carolina State University, Electrical Engineering, 1991; MS, Old Dominion University, Electrical Engineering, 1986; BS, Old Dominion University, Electrical Engineering, 1984

Research Interests Real-time computer vision, Multimedia systems, Medical imaging

Recent Research Projects Global surveillance augmentation for deep learning, Real-time systems for object tracking and activity recognition, Algorithms and systems for robust scene categorization and object classification in consumer photographs, Document processing algorithms for thresholding, compression, and rendering in high-speed scanners, Digital image processing and computer vision

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Education ScD, Polish Academy of Sciences, Physics, 1992; PhD, Polish Academy of Sciences, Physics, 1983; MS, Warsaw Technical University, 1975

Research Interests Ultrafast optoelectronics, Quantum optoelectronic and spintronic devices, Ballistic transport in electronic nanodevices, Quantum communication and information

Recent Research Projects Quantum key distribution using polarized infrared single photons for practical quantum cryptography and deep-space optical communications, Subpicosecond electro- and magneto–optic characterization of electronic, optoelectronic, and spintronic materials and systems, Smart sensor for classical and quantum data links

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Education PhD, University of Padova (Italy), Information Engineering, 2012; MSc, University of Padova (Italy), Computer Engineering, 2008; BSc, University of Padova (Italy), Computer Engineering, 2005

Research Interests Wireless communication and networking, Mobile cloud computing, Smart and connected health care solutions, Stochastic modeling and optimization, Design of novel techniques to facilitate the development and diffusion of smart and connected health care solutions

Recent Research Projects Design and optimization of large ad-hoc networks

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NICK VAMIVAKAS

Professor of Quantum Optics and Quantum Physics, University of Rochester

Education PhD, Boston University, Electrical Engineering, 2008; BS, Boston University, Electrical Engineering, 2001

Research Interests Light-matter interaction at the nanoscale, Quantum optics, nano-photonics and condensed matter physics

Recent Research Projects Solid-state and photonic approaches to quantum science

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Education M.S, Rochester Institute of Technology, Mixed-Signal ASIC; B.S, Rochester Institute of Technology, Microprocessor Design

Research Interests Application-specific Integrated Circuits, High Speed communication Interfaces, Low-cost/high-reliability Electronics, Embedded Microprocessors, High-speed Digital, Mixed Signal, High-power PCBAss

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HUI WU

Professor of Electrical and Computer Engineering, University of Rochester

Education PhD, Electrical Engineering, California Institute of Technology, 2003; MS, Microelectronics, Tsinghua University, Beijing, 1998; BS, Tsinghua University, Beijing, 1998

Research Interests Wireless sensors for smart health care, Spintronic and nanoelectric integrated circuits, On-chip interconnect and power distribution for high performance microprocessors, Silicon photonics, optical interconnect and electronic-photonic integrated circuits, High-performance clock generation and distribution, High-speed and ultra-wideband integrated circuits, High-speed passive devices and on-chip interconnect

Recent Research Projects Optical phased array for adaptive free-space optical imaging, Free-space optical interconnect for future microprocessors, Transmission-line based shared-medium on-chip electrical interconnect, Ultrafast pulse generation, filtering and modulation, Ultrafast pulse shaping for Omega laser system, Injection-locked clocking, High-speed silicon photodetectors in standard CMOS, Ultra-wideband (UWB) impulse radios, CMOS-compatible on-chip transmission lines, Integrated microwave passive devices

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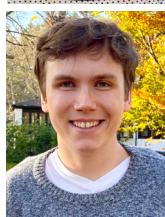(585) 275-2104
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CEIS ADVISORY BOARD

The advisory board and CEIS leadership meet and discuss strategies to expand new technologies and enhance the connection between academic research and corporate product development. The entire CEIS team would like to acknowledge and thank the advisory board for their leadership, expertise, and forward-focused ideas:

Bob Naum
Chair

Ian Cox
IGC Consulting Group

Bob Fiete
L3Harris Technologies

Ellen Kosik-Williams
Corning, Inc.

Ryne Raffaelle
Rochester Institute of Technology

WELCOME TO THE NYSTAR FAMILY

CEIS wishes a warm welcome to the recently awarded Center of Excellence in RNA Research and Therapeutics (CERRT). The center is a partnership with the University of Rochester and the University at Albany with the goal of focusing on developing RNA-based therapies and training the next generation of New York's biotechnology workforce. CERRT's efforts will bring new discoveries closer to patients and contribute to the state's growth as a hub for health and technology R&D. The CERRT joins 14 other centers based at universities across New York in the Centers of Excellence (CoE) program which is managed by Empire State Development's (ESD) Division of Science, Technology, and Innovation (NYSTAR). Welcome aboard CERRT!

Photo credit: J. Adam Fenster, University of Rochester

Lynne Maquat (right) and postdoctoral research Elizabeth Abshire (left) give Assemblymember Harry Bronson a tour of the Maquat Lab at the University of Rochester Medical Center after the press conference announcing the launch of the Center of Excellence in RNA Research and Therapeutics, a joint venture with the University of Rochester and the University at Albany.

CENTER FOR **EMERGING AND INNOVATIVE SCIENCES**

Cover image: Researchers at the University of Rochester's new Translational Center for Barrier Microphysiological Systems (TraCe-bMPS) develop drug development tools using the modular, mass-producible µSiM chips pictured on cover and pioneered by center director James McGrath, the William R. Kenan Jr. Professor of Biomedical Engineering.

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